

Overview

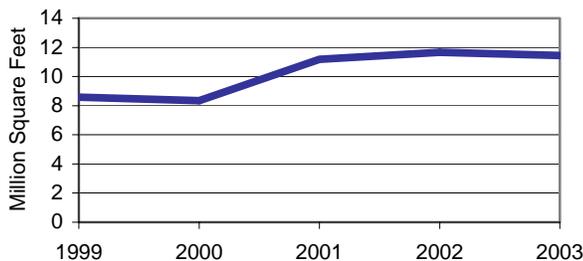
Summary

While the U.S. solar collector market was ho-hum in 2003, the photovoltaic cell and module business was anything but dull. The second-largest manufacturer of photovoltaic (PV) cells and modules, AstroPower, went bankrupt. Other major manufacturers significantly changed their relative outputs of cells and modules, as well as entering and leaving major end-use markets. The result was the first decline in total peak kilowatt production of photovoltaic cells and modules since EIA resumed collecting such data in 1986.

Solar Thermal Collectors

The solar collector market was lackluster in 2003. Total and domestic shipments of solar collectors remained close to 2002 and 2001 levels (Tables 10 and 11 and Figure 1). Total sales were 11.4 million square feet, down 2 percent from 2002. Domestic shipments of 10.9 million square feet declined a similar amount from 2002 levels. The number of companies shipping solar collectors has remained steady since 2000.

Figure 1. Total Solar Thermal Collector Shipments, 1999-2003



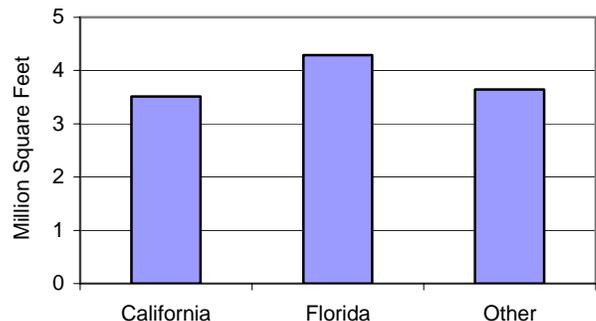
Source: Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Low-temperature collectors continued to dominate the market in 2003, with a 95 percent share (Table 12). Nearly three-fourths of all collectors were produced in five domestic locales: California, New Jersey, Florida, Puerto Rico, and Tennessee (Table 13a), with two-thirds shipped from California and New Jersey alone. As in the past few years, around 80 to 85 percent of solar collectors were sent to the top 5 destinations (Table 13b). For 2003, these states were: Florida, California, New Jersey, Arizona, and Hawaii.

All but New Jersey have relatively high incidences of heated swimming pools. Over two-thirds were shipped to just Florida and California (Figure 2).

The small (0.5 million square feet) solar collector export market was dominated by sales to Canada, Mexico, and

Figure 2. Solar Thermal Collector Shipments Top Destinations, 2003

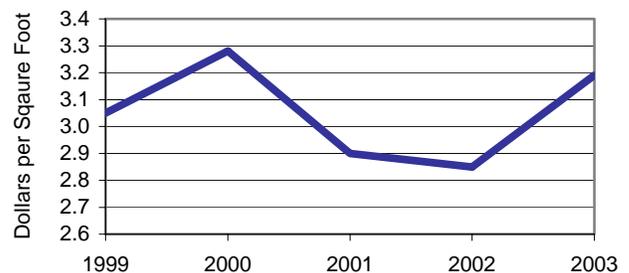


Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Austria (Table 15). Collectors were shipped to various kinds of business in similar proportions for both 2002 and 2003 (Table 16).

Steady sales produced steady prices for the dominant low-temperature collector in 2003. The average price per square foot rose slightly to \$2.08 from \$1.97 in 2002 (Table 17). Medium- and high-temperature collectors went for a somewhat higher average price, resulting in the overall average price per square foot of all solar collectors rising to \$3.19 in 2003 from \$2.85 in 2002 (Figure 3).

Figure 3. Solar Thermal Collector Average Prices, 1999-2003



Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Shipments by market sector, end use, and type were also similar in 2003 to 2002 (Table 18). The only shift of any size was between the residential and commercial sectors.

One of the few notable differences between 2002 and 2003 solar collector shipments was in complete shipments. The number of complete systems rose 15 percent to 7,266 systems in 2003 (Table 19). Moreover the value of complete shipments increased even more— 31 percent. This difference is likely due to the average size of a complete collector decreasing from 143 square feet to 119 square

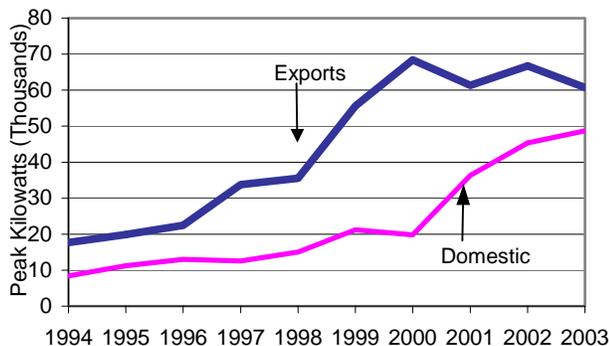
feet, requiring fixed per system costs to be spread over a smaller collector area.

Sales concentration remained constant during 2003, with 92 percent of sales made by the 5 largest firms (Table 21). This concentration has stayed between 90 and 96 percent over the past 5 years. New product introduction continues to be anticipated by only a few companies (Table 20); employment is near the 5-year industry average (Table 22); and except for non-collector system component manufacture, solar collector companies are remaining in the same lines of work (Table 23) as in recent years. Companies which produce solar products continue to do so as the predominant portion of their business (Table 24).

Photovoltaic Cells and Modules

After uninterrupted increases for nearly two decades, shipments of photovoltaic (PV) cells and modules declined 2.5 percent in 2003 to 109,357 peak kilowatts (Table 26). Exports dropped sharply—9 percent—while domestic shipments rose 7 percent (Table 10 and Figure 4).

Figure 4. Photovoltaic Exports and Domestic Shipments, 1994-2003



Sources: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey," and Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

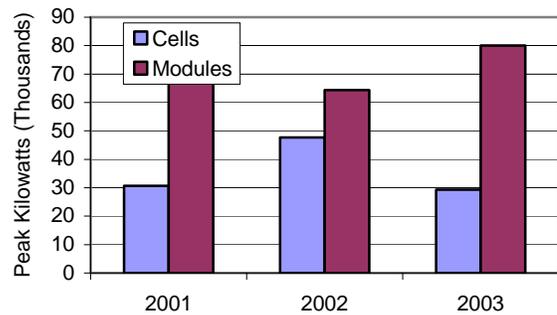
Module shipments increased 24 percent to 80,062 peak kilowatts, but cell shipments decreased to 29,295 peak kilowatts from 47,677 peak kilowatts in 2002 (Table 25 and Figure 5).

Two major events occurred in the PV industry during 2003 that affected cell and module shipments:

- The second-largest producer of PV cells and modules, AstroPower, went bankrupt. Its assets were purchased by General Electric's solar division. The bankruptcy had a major impact on the amount and distribution of cell and module shipments, as will be described later.
- Shell Solar repurchased substantial quantities of cells during 2003 for module manufacture.

Both of these events affected shipments to business categories. Shipments to module manufacturers decreased nearly two-thirds, owing largely to Shell Solar cell

Figure 5. Photovoltaic Cell and Module Shipments, 2001-2003



Source: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

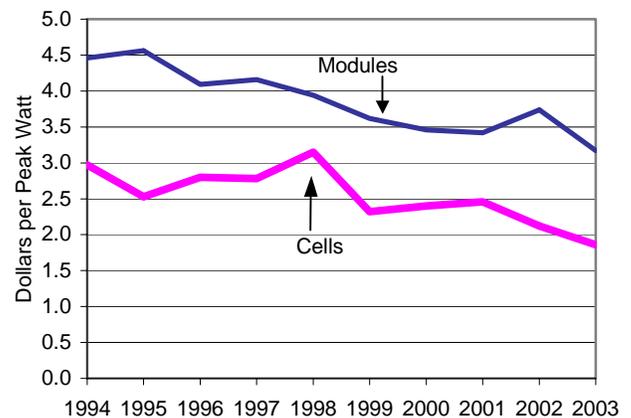
repurchases, which are treated as negative shipments (Table 27). In contrast, shipments to exporters and end-users rose substantially.

Single crystal cell and module shipments suffered the worst drop in 2003 of all PV technologies, falling 15,000 peak kilowatts (Table 28). This was due in large measure to the fact that AstroPower produced only single crystal cells. The sharp increase in cast and ribbon cell and module shipments was largely due to one company, RWE, expanding its module capacity substantially during 2003. Other companies also expanded module capacity.

Softer shipments also adversely affected prices in 2003. The average cell price per peak watt for the most prevalent technology, single-crystal silicon, dropped to \$1.88 from \$2.14 in 2002 (Table 29). Single-crystal module prices also dropped, despite increased shipments, from \$3.64 in 2002 to \$3.38 in 2003.

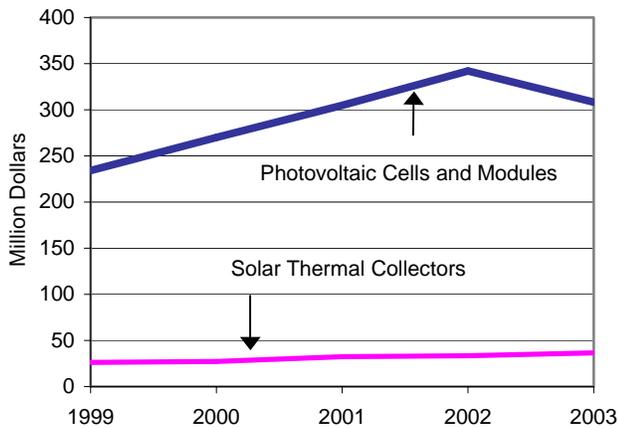
The average price per peak watt of all PV cells displayed a similar pattern (\$2.12 to \$1.86), while the average price of

Figure 6. Photovoltaic Cell and Module Average Prices, 1994-2003



Source: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Manufacturers Survey."

Figure 7. Solar Equipment Manufacturers' Value of Shipments, 1999-2003



Sources: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey," and Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

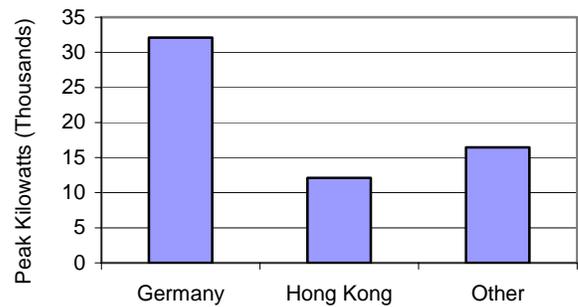
modules declined more (\$3.74 to \$3.17) than did the price of single-crystal modules (Figure 6).

The decline in average price combined with the drop in shipments to reduce the total value of PV shipments to \$308 million in 2003, a 9 percent decline from 2002 (Figure 7). The value of PV shipments still outweighs the value of solar thermal collectors by an 8:1 margin.

Market sector and end-use distributions of PV shipments in 2003 changed considerably from 2002. Shipments in 2003 to the industrial and residential markets declined sharply, 13 and 20 percent, respectively (Table 30). Commercial shipments, in contrast, rose nearly 60 percent from about 21,000 peak kilowatts in 2002 to nearly 33,000 peak kilowatts in 2003. Much of the commercial market increase was due to Shell Solar, which discontinued its recreational vehicle kits and began providing rooftop applications in 2003. This made the commercial market the largest market for PV shipments in 2003, supplanting the industrial market. The distribution of former Astropower markets also affected 2003 market sector shipments substantially.

Shell Solar's product switch also affected the distribution of shipments to end-use categories. Shipments to the transportation sector declined in 2003 by nearly 2,000 peak kilowatts, or 12 percent. Also, grid-interactive electricity generation shipments, which are how rooftop applications

Figure 8. Photovoltaic Export Shipment Top Destinations, 2003



Source: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

are generally used, rose almost 9,000 peak kilowatts to over 42,000 peak kilowatts in 2003. With nearly a 40 percent share in 2003, the grid-interactive application increased its position as the predominant use of PV cell and module shipments, up from 30 percent in 2002.

PV exports were split nearly 50:50 between cells and modules during 2003 (Table 31). This was fairly similar to the 2002 pattern, when cells held a slight edge. Over half of 2003 PV exports were to Germany, which imported 2.5 times more U.S. cells and modules than the next-largest importer, Hong Kong (Table 32 and Figure 8).

Shipments of complete PV systems dropped 21 percent in 2003, yet the total peak kilowatts and value of shipped systems actually rose substantially (Table 33). These characteristics are heavily influenced by Shell Solar's change in product mix to larger rooftop installations. These developments affected prices. While the price per system increased more than 40 percent in 2003, the price per peak kilowatt dropped only slightly (\$5.28 in 2003 versus \$5.51 in 2002).

Employment in the PV manufacturing industry dropped slightly in 2003 but remained at approximately 2001-2002 levels (Table 34). Employment rose fairly steadily from 1994 through 1998, then remained stable through 2000. Despite only a 10 percent market share, 5 companies plan to introduce new thin-film products (Table 35). More companies (7) are planning for new products using crystalline silicon technology. No new flat plate or concentrator products are planned. The number and type of companies involved in PV-related businesses remained essentially unchanged in 2003 (Table 36).